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IS 14784 (2000): Fireworks Signal Flares [CHD 26: Explosives and Pyrotechnics]

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आतिशबाजी संकेत देने की रोशनी — विशिष्टि

Indian Standard

FIREWORKS SIGNAL FLARES — SPECIFICATION

ICS 71.100.30

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 2000

Price Group 4

Explosives and Pyrotechnics Sectional Committee, CHD 26

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Explosives and Pyrotechnics Sectional Committee had been approved by the Chemical Division Council.

The fireworks signal flares are made of pyrotechnic materials and are used chiefly for the purpose of entertainment. They are popularly known as 'Parachute'. They are safe to use when operating under principle of well controlled emission of colour stars, sound or parachute with colour flares vertically in to the air. A charge of pyrotechnic composition, generally filled and sealed in paper mortar or paper board mortar alongwith parachute being the basic components.

The production of fireworks signal flares in this country is confined to the small scale sector.

This standard covers only the fireworks signal flares used for entertainment purposes. This standard has not included the signal flares used in life boats and life rafts equipment in accordance with *Life Saving Appliances Rules*. 1986 under *Merchant Shipping Act*, 1958.

There is no ISO Standard on this subject.This standard has been prepared based on indigeneous manufacturers' data/practices prevalent in the field in the country.

The composition of committee responsible for formulating this standard is given in Annex K.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard
FIREWORKS SIGNAL FLARES — SPECIFICATION

1 SCOPE

This standard prescribes the requirements and methods of sampling and test for fireworks signal flares or parachute.

2 NORMATIVE REFERENCES

The Indian Standards listed below contain provisions which through reference in this text, constitute provision of this Indian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the Indian Standard indicated below:

IS No.	*Title*
301 : 1982	Specification for potassium nitrate for explosive and pyrotechnic compositions *(second revision)*
1070 : 1992	Reagent grade water *(third revision)*
4396 : 1981	Specification for barium nitrate for explosive and pyrotechnic compositions *(first revision)*
4905 : 1968	Methods for random sampling
5671 : 1984	Specification for strontium nitrate for pyrotechnic compositions *(first revision)*
12276 : 1988	Specification for dextrin for explosives and pyrotechnic industry

3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply.

3.1 Fireworks Signal Flares or Parachute

The fireworks signal flares or parachute shall consist of small cylindrical shell or spherical shell made of paper and charged with an amount of a composition of pyrotechnic material intermixed with colour pellets alongwith parachute made of plastic paper fitted with flares. Such assembled set is then placed in paper or paper board mortar above the propellant previously filled in the mortar. The top of the mortar is sealed and fitted with quick matches in such a way that when ignited by the ignitor, colour stars and parachute with flare. All the composition of pyrotechnic shall be approved by statutory authority.

3.2 Quick Matches

Quick matches shall be flexible in nature and consist of strands of cotton or jute yarn dipped in a pyrotechnic composition approved by the Chief Controller of Explosives and finally wrapped with tissue paper with the help of ordinary gum.

4 GRADES

The fireworks signal flares shall be of 3 grades as given in Table 1 according to the nominal mass of charge of pyrotechnic material and size.

5 REQUIREMENTS

5.1 The inner shell of fireworks signal flares shall explode at its required height only (*see* Annex A).

5.2 The inner shell shall be projected into sky at the height mentioned in Table 1 (*see* Annex B).

5.3 The parachute with flare burning shall hang in the sky for the time as mentioned in Table 1.

5.4 On ignition, fireworks signal flare shall produce the number of parachutes according to its grade as shown in Table 1.

5.5 The flare of parachute before falling to ground shall be extinguished itself.

5.6 The length of quick matches and burning shall be so appropriated as to provide not less than 10 s and not more than 15 s before the emission starts. Test for the same shall be conducted according to method given in Annex C.

5.7 A wooden base should be provided with a hole at the centre. The fireworks signal flare shall be exactly fitted in wooden base hole. The fireworks signal flare fitted in the base shall pass the test for the tilting over which shall be done according to the procedure prescribed in Annex D.

5.8 Physical Parameters

5.8.1 *Height and Diameter*

5.8.1.1 *For grade* 1

The height and diameter of the fireworks signal flare shall be within 19 ± 1 cm and 3.3 ± 0.2 cm respectively.

5.8.1.2 *For grade* 2

The height and diameter of the fireworks signal flare shall be within 26.5 ± 1 cm and 5 ± 0.5 cm respectively.

Table 1 Parameters for Fireworks Signal Flares

(*Clauses* 4, 5.2, 5.3 *and* 5.4)

Sl No.	Grade	Length of Outer Tube	Diameter of Outer Tube	Length of Inner Tube	Diameter of Inner Tube	Mass of Composition in Outer Tube (g)	Mass of Composition in Inner Tube (g)	Size of Flare	Weight of Flare	Time of Handling of Flare	Height of Flight	Time of Falling	No. of Parachutes
		cm	cm	cm	cm	*Min*	*Min*	cm	*Min*	s	m	s	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
i)	2	19±1	3.3±0.2	9.0±0.5	2.9±0.2	18.5	8.5	1.2×2.5	2	9	15	20±2	1
ii)	1	26.5±1.0	5.0±0.5	13.0±0.5	4.5±0.2	45	13	1.5 × 3	5	10	57	30±2	1
iii)	3	33±1	6.0±0.5	14.0±0.5	5.0±0.2	45	18	1.2 × 5	6	25	75	35±2	5

5.8.1.3 *For grade* 3

The height and diameter of the fireworks signal flare shall be within 33 ± 1 cm and 6 ± 0.5 cm, respectively.

5.8.2 The mortar and inner shell shall be made of paper or paper board or any other material approved by the Chief Controller of Explosives.

5.8.3 The fireworks signal flare shall be free from any holes, splits, dents or bulges. The quick matches fitted in the item shall not be loose or missed. The tests for **5.8.1** to **5.8.3** shall be conducted according to Annex E.

5.9 Composition of Pyrotechnic Charge

5.9.1 The colour pellet shall contain a mass of mixture of pyrotechnic material (*see* Annex F) approved by the Chief Controller of Explosives.

The mixture shall consist of the following chemicals:

a) Barium nitrate (*see* IS 4396),

b) Strontium nitrate (*see* IS 567),

c) Potassium nitrate (*see* IS 301),

d) Aluminium powder,

e) Aluminium magnesium alloy powder,

f) PVC resin, and

g) Dextrin (*see* IS 12276).

5.9.2 The propellant and bursting charge shall contain a mass of a mixture of pyrotechnic material (*see* Annex F) approved by the Chief Controller of Explosives.

The mixture shall consist of the following chemicals:

a) Potassium nitrate,

b) Charcoal powder, and

c) Sulphur powder.

5.9.3 The pyrotechnic composition of propellant, bursting charge, colour pellet and flares shall be found to contain no chlorate when tested by the method prescribed in Annex G.

6 CONSTRUCTION

6.1 Mortar

The shell shall be rolled from cardboard or moulded from cardboard pulp. The finishing bottom shall be concave type.

6.2 Seal

The bottom of the mortar shall be closed with cardboard and a mixture of fine sand dust, glue and gum in such a way as to prevent seepage of the composition.

6.3 Inner Shell

The inner shell shall be made from paper/cardboard/pulp. The bottom of inner tube shall be crimped alongwith a tube fuse or the bottom of the inner shell shall be closed in a mixture of fine saw dust and glue/gum.

6.4 Base

A base of suitable material and size with a hole at the centre of such a size that fireworks signal flare can be fitted tightly into it and shall remain stable while functioning.

7 STABILITY DUE TO SPONTANEOUS COMBUSTION

Each of four explosives composition used in the manufacture of fireworks signal flare shall pass the stability test at 100 ± 2°C for 2 h when tested by the method given in Annex H.

8 PACKING AND MARKING

8.1 Packing

The fireworks signal flares shall be placed on their sides well inside the suitable cardboard boxes. They shall fit tightly into the boxes. They shall be packed in tens in boxes. Ten such boxes shall be packed in packets.

8.2 Marking

8.2.1 Each box and packet shall be legibly and indelibly marked with the following information:

a) Name and grade of the material;

b) Name of the manufacturer and/or his recognized trade-mark; and

c) Batch number in code or otherwise to enable the lot of manufacture to be traced from records.

8.2.2 In addition to the above, the following cautionary note shall also appear on the label and a small caution slip with the same information shall be placed inside the smallest box:

> "WARNING" FLAMMABLE, FOR OUTDOOR USE ONLY. USE ONLY UNDER ADULT SUPERVISION. SHOOTS FIREWORKS SIGNAL OR PARACHUTE WITH FLARES. DO NOT HOLD IN HAND. PLACE IN BASE OR STAND ON LEVEL OPEN SURFACE. LIGHT FUSE AND GET AWAY.

8.2.3 The pictorial view of the functions and procedure of ignition of the fireworks signal shall also be printed on the smallest packet.

8.2.4 *BIS Certification Marking*

The packages may also be marked with the Standard Mark.

The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 TEST METHODS

9.1 The test for the requirements laid down in **5.1**, **5.2** and **5.6**, **5.7**, **5.8.3**, **5.9.1**, **5.9.3** and 7 shall be carried out as prescribed in Annex A to H of this standard.

9.2 Quality of Reagents

Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070) shall be employed in the tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

10 SAMPLING

Representative samples of the material shall be drawn and conformity of the material to the requirements of the specification shall be determined according to the procedure prescribed in Annex J.

ANNEX A

(*Clauses* 5.1 *and* 9.1)

TEST METHOD FOR DETERMINING HEIGHT OF FLIGHT OF SIGNAL FLARE

A-1 The fireworks signal flare during flight could be observed with help of a sextant placed at a distance '*D*' from the initial position of the fireworks signal flare (*see* Fig. 1). Angle of elevation of the maximum point the parachute reached can be measured from the distance and the angle of elevation, the height is calculated as given below :

$$H = D \tan \theta + h$$

where

h = height of the sextant stand.

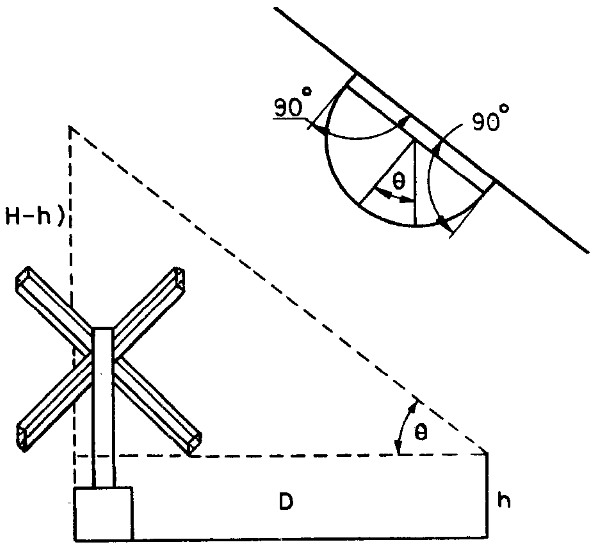

FIG. 1 DETERMINATION OF ANGLE OF FLIGHT OR HEIGHT OF SIGNAL FLARES

ANNEX B

(*Clauses* 5.2 *and* 9.1)

TEST FOR PERFORMANCE

B-1 GENERAL

The performance test shall be carried out only if the wind speed measured at a height of 2 m above the ground level does not exceed 24 km/h.

B-2 PROCEDURE

Place the mortar tube in accordance with the instructions on the label but ensure that it is vertical, in the centre of the test area. Straighten the initial quick matches and ignite the quick matches and start timing device. Immediately observe and record the time when the parachute shell is projected from the mortar tied and whether the shell explodes at a required height above the ground. Observe and record what other principal effects (in addition to projection of parachute and explosion with colour or white shower) are produced by the item. Observe whether any burning or incandescent matter falls without being extinguished falling in the ground. Observe and record time of falling on the ground.

If the shell fails to be projected from mortar tube, do not continue with the testing unless the test is halted (under conditions stated above), repeat the above operation for each of five samples.

ANNEX C

(*Clauses* 5.6 *and* 9.1)

BURNING TIME FOR QUICK MATCHES

C-1 PROCEDURE

The rate of burning of quick matches shall be determined by carefully taking out the quick match from the fireworks signal flare shell. The said quick matches shall be placed on asbestos sheet and ignited at one end. Observe and record the time. Repeat test for five samples.

ANNEX D

(*Clauses* 5.7 *and* 9.1)

TEST FOR THE TILTING OVER OF THE FIREWORKS SIGNAL FLARE

D-1 PROCEDURE

The fireworks signal flare is placed, with its base on the tilt test device (*see* Fig. 2). The inclined surface is covered with a grit paper to prevent sliding down of the fireworks signal flare. The unlit fireworks signal flare when placed on the test device shall not tip over on the test device's 10° inclined surface.

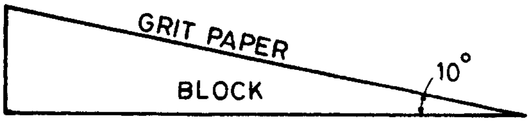

FIG. 2 TILT TEST DEVICE

ANNEX E

(*Clauses* 5.8.3 *and* 9.1)

METHOD FOR PHYSICAL TESTING

E-1 PHYSICAL EXAMINATION OF FIREWORKS SIGNAL FLARES

Examine the fireworks visually and determine whether there are any holes, splits, dents or bungles, bulges in the outer tube and whether the initial fuse is loose or missing. If any such fault is found, record the fact and do not proceed with the performance testing. Measure its outside diameter and height and check that initial fuse is fitted.

ANNEX F

(*Clauses* 5.9.1, 5.9.2 *and* 9.1)

DETERMINATION OF THE MASS OF THE CHARGE

F-1 PROCEDURE

The mass charge of explosives and pyrotechnic composition in the inner tube and outer shell of the fireworks signal flare shall be determined by carefully cutting open first the outer mortar shell and collecting the charge and weighing it on a tared disc or glazed paper and then cutting open the inner tube and collecting the charge and weighing it on a tared disc or glazed paper. The cutting shall be done with the use of non-ferrous, non-spark producing knife or shear. This operation shall be carried on a place out of reach of naked flames and bare and live electric conductor.

ANNEX G

(*Clauses* 5.9.3 *and* 9.1)

TEST FOR CHLORATE

G-1 REAGENTS

G-1.1 Aniline Hydrochloride

Dissolve 18 g of redistilled aniline in 375 ml of concentrated hydrochloric acid and make up the volume to 500 ml with water. Add 2 drops of saturated potassium chlorate solution, shake and allow to stand overnight. Filter off the blue sediment, store the reagent in a glass stoppered bottle in the dark.

G-1.2 Concentrated Hydrochloric Acid

G-2 PROCEDURE

To 5 g of the sample taken in a spot plate, add few drops of aniline hydrochloride in hydrochloric acid. The material shall be considered chlorate free if there is no bluish green precipitation or colouration.

G-3 The above test shall be reported for each of the four compositions used in the manufacture of fireworks signal flares.

ANNEX H

(*Clauses* 7 *and* 9.1)

TEST FOR STABILITY DUE TO SPONTANEOUS COMBUSTION

H-1 PROCEDURE

Heat slowly 0.5 g of the composition mixture in a dish on a sand bath to a temperature of 100 ± 2°C for 2 hours. Moisten the mixture with water and again dry. The material shall be considered to have passed the test if it does not ignite spontaneously.

H-2 The above test shall be reported for each of the four compositions used in the manufacture of fireworks signal flare.

ANNEX J

(*Clause* 10)

SAMPLING OF FIREWORKS SIGNAL FLARES

J-1 SAMPLING

J-1.1 Lot

All the boxes of fireworks signal flares belonging to the same batch of manufacture shall constitute a lot.

J-1.2 For ascertaining the conformity of the material with the requirements of the specification, samples shall be tested from each lot separately.

J-1.3 The number of packets to be selected from a lot shall depend on the size of the lot and shall be according to Table 2.

J-1.4 The packets from the lot and also the boxes from the selected packets shall be selected at random. In order to ensure randomness of selection procedures given in IS 4905 may be followed.

J-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

J-2.1 The packets selected as per col 2 of Table 2 and the boxes in them shall be examined for packing and marking requirements as well as precautionary label. All the packets and boxes shall fulfil these requirements.

J-2.2 The number of boxes as per col 3 shall be selected at random from each of the sample packets for all other requirements. The required number of fireworks signal flare as per col 4 shall be selected approximately in equal numbers from each of the boxes. These fireworks signal flares shall be individually tested for requirements given in **5.1** to **5.7**. Any item failing in one or more of the requirements shall be termed as defective. The number of defectives shall not exceed the value given in col 5 if the lot is to be accepted under this clause.

J-2.3 The lot shall be finally considered to be conforming to the requirements of the specification if the criteria for conformity given in **J-2.2** is satisfied.

Table 2 Scale of Sampling

(*Clauses* J-1.3 *and* J-2.1)

No. of Packets in the Lot (1)	No. of Packets to be Selected (2)	No. of Boxes to be Selected (3)	No. of Fireworks Signal to be Selected (4)	Permissible No. of Defectives (5)	Sample Size for Testing Chlorate (6)
Up to 50	2	5	13	1	1
51 to 100	3	8	20	2	2
101 to 300	5	13	32	3	3
301 to 500	7	20	60	5	4
501 and above	10	32	80	7	5

ANNEX K

(*Foreword*)

COMMITTEE COMPOSITION

Explosives and Pyrotechnic Sectional Committee, CHD 26

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(*Continued on page* 8)

(*Continued from page* 7)

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards : Monthly Additions'.

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 323 01 31, 323 94 02, 323 33 75

Telegrams: Manaksansth
(Common to all offices)

Regional Offices:	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	323 76 17 323 38 41
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	337 84 99, 337 85 61 337 86 26, 337 86 62
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43 60 20 25
Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
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